

Will the Soviet Union deploy an x-ray laser by 1985?

by Robert Gallagher

Three and a half months after *EIR* forecast early deployment of a Soviet x-ray laser anti-ballistic missile device (*EIR*, Dec. 13, 1983), the popular aerospace industry magazine *Aviation Week and Space Technology* reported in its April 2 issue that the Soviets have a serious development program at the Lebedev Physics Institute and the Kurchatov Institute of Atomic Energy for a nuclear-pumped x-ray laser "similar in design to the device being developed in the U.S. by the Lawrence Livermore Laboratory."

The much-touted U.S. "lead" in x-ray laser technology appears to have evaporated overnight. Could it be that an x-ray laser is one of the many new weapons systems that Central Intelligence Agency officials warned last fall the Soviets would deploy in 1984 or 1985? At that time, the officials stated at a press conference that the Soviets had more military systems in research and development than at any time during the 1960s or 1970s. They reported that in the first eight months of 1983, there had been a "dramatic" increase in investment and floor space in military-oriented machining industries on the order of 40%. The CIA forecast that this engineering activity would result in deployment of a series of new weapons systems of all types in 1984 and 1985.

Aviation Week has sounded an alarm: "U.S. officials added that the Soviet Union is at least 10 years ahead of the U.S. in some important areas of directed-energy weapons technology that can be applied to a layered ballistic missile defense capability."

These reports demolish arguments by the Union of Concerned Scientists and others opposed to a U.S. ABM effort that the x-ray laser device is not feasible. Richard L. Garwin of IBM, for example, put forward this argument last April, using an article by Lenin Prize winner F. V. Bunkin of the Lebedev Institute published in the Soviet *Journal of Quantum Electronics*. Bunkin is currently one of the coordinators of the successful Soviet x-ray laser program! (*EIR* refuted Garwin's argument in our July 19, 1983 issue.)

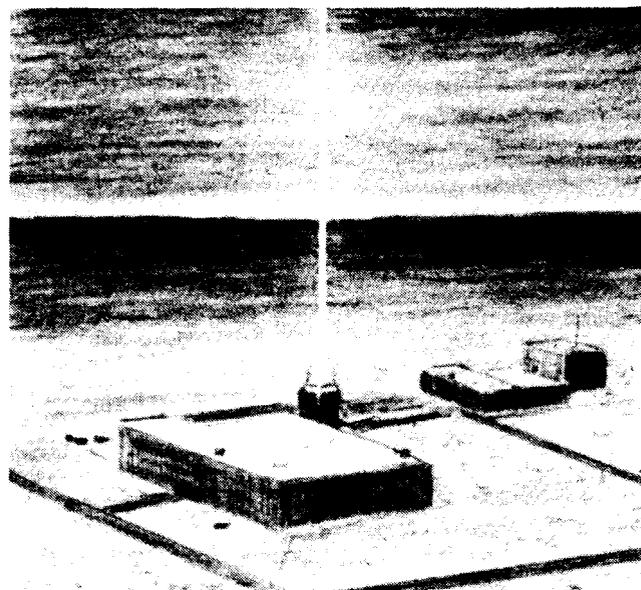
Other top Soviet nuclear physicists have hastened to back the arguments of Garwin et al. that an *American* beam-weapon program is a waste of effort. Yevgeny P. Velikhov, vice-president of the Soviet Academy of Sciences, signed a declaration in April 1983 denouncing President Reagan's March 23 policy for development of directed-energy antiballistic-

missile systems. He repeated the same at the Erice conference on nuclear-weapons policy in Italy in August. He then made a surprise appearance in Washington in December alongside Sen. Edward Kennedy and astrologer Carl "Nuclear Winter" Sagan to again denounce the Reagan initiative—but evaded questions on the Soviet program.

A top priority program

The Soviets have made development of an x-ray laser a research priority of their Academy of Sciences for over a decade. A. A. Rukhadze at the Lebedev Physics Institute in Moscow and Ya. B. Faynberg of the Physicotechnical Institute in Khar'kov have led scientists in this effort since the early 1970s. A 1975 Rand Corporation report, "High Current Particle Beams: I. The Western U.S.S.R. Research Groups," noted:

Both Rukhadze and Faynberg are concerned with novel methods of pumping lasers emitting in the ul-



This directed-energy R & D site at the Sary Shagan proving ground in the central U.S.S.R. could provide some anti-satellite capabilities today and possibly ABM prototype testing in the future.

Soviet Military Power

traviolet portion of the spectrum. Rukhadze's technique employs exploding wires [as does the Lawrence Livermore device—RLG] and is found to be superior to conventional flash lamps in terms of delivered energy and ultraviolet conversion efficiency.

Rukhadze concentrated much of his team's work on using relativistic electron beams to pump the lasing medium. Rand further reported:

According to Soviet statements, ultra-relativistic electron beams can convert 1% of their energy into x-ray beams whose power can reach one trillion watts with a [beam] divergence of 1°. Injection of such high power x-ray beams into dense gases [e.g., a zinc plasma—RLG] may produce stimulated x-ray emission [i.e., lasing—RLG].

At the same time that Rukhadze's group at Lebedev pursued such applications of directed-energy beams, Academician Velikhov led a group of scientists at the Kurchatov Institute in development of nuclear explosive pumped systems to provide pulsed power for directed-energy beams and—it appears now—to provide energy for x-ray lasing. For this work, the Soviets developed huge spherical blast chambers capable of withstanding small nuclear blasts. U.S. Air Force Gen. (ret.) George Keegan revealed in 1977 that such systems exist at Semipalatinsk, U.S.S.R. for driving directed-energy devices and that nuclear debris emitted from the site indicates that testing began in the early-to-mid 1970s.

Aviation Week's report shows that the Soviets have done the predictable: they have combined the work of the Rukhadze and Velikhov groups to produce a nuclear-pumped x-ray laser device. F. V. Bunkin at the Lebedev Institute is coordinating work on the device and the Kurchatov team is providing "technical support" in the area of "nuclear-weapons plasma." This report is just the tip of the iceberg of Soviet directed-energy weapons work. As they move more and more programs into an engineering phase—where the existence of a program necessarily becomes known to many people and hence more difficult to keep secret—more and more will become known in the West.

Other Soviet breakthroughs

The Soviets have made three other breakthroughs in technology required for an energy-beam defense. All are in areas in which the United States supposedly held an "undisputed" lead and in which the Soviets were presumed to be so far behind that they couldn't be expected to field a layered defense system within a decade.

Computers: The Soviets have developed a computerized guidance system for a new generation of cruise missiles with an accuracy close to that claimed for the U.S. ground-launched cruise missile. *Aviation Week* reported Jan. 2 that the development "has taken the Defense Dept. and the intelligence

community by surprise," and that one official "called the rapidly developed guidance capability 'scary,' adding that the advance of technology also is showing up in a number of other areas as well as fighter aircraft and antiballistic missile defense."

Adaptive optics: One Soviet program has applied adaptive optics to solve the problems of beam divergence and breakup in propagation through the atmosphere, according to a report in *Aviation Week* last December. Presidential science adviser George Keyworth announced last fall that U.S. scientists had just solved this problem. The Soviet program is developing a system for laser communication with submarines. The system is reportedly composed of a ground-based blue-green laser and an orbiting mirror which directs the beam down to submerged submarines. Bunkin is also heading up this program and has made trips to the Lebedev Institute field station at Feodosiya near Sevastopol on the Black Sea for tests. Bunkin's program is about five to ten years ahead of the similar program managed by the Defense Advanced Research Projects Agency. DARPA does not even contemplate a date for orbiting a test mirror.

Laser Optics: Two other Lebedev Institute scientists, Subariev and Faisulov, have solved a problem in laser optics relevant to beam collimation, according to a *Novosti* release last month. The solution reportedly involves uses of a crystalline substance as a mirror with time-varying properties. (Both these developments and the U.S. advance in optics will be treated in a future report.)

Such developments are just a small piece of the picture and are either unclassified (such as the Subariev work) or simply what has leaked out since the Soviets imposed rigid classification following the Keegan disclosures in 1977.

The Soviet Academy of Sciences manages an extensive network of laboratories devoted to directed-energy technology research in a wide range of areas from pulsed power systems to beam-generation devices. One focus of Soviet researchers in all areas is miniaturization of all systems. As Rand wrote:

This goal [ionospheric sounding], usually referred to together with the production of artificial auroras, requires the delivery of relatively large energies supplied by electron accelerators aboard space vehicles. It appears as one reason for the evident Soviet stress on minimizing the size of electron beam accelerators for a given beam energy and for the theoretical work on beams [propagation] in atmospheric gas.

Leonid Rudakov, Rukhadze, and others have emphasized development of compact devices for generation of relativistic-electron beams, which have in turn been flown on spacecraft supposedly for experiments in injection of beams into the ionosphere (ionospheric sounding). The same device and mode of deployment could drive a space-based laser.